

## CLAIMS

What is claimed is:

1. A tool (20) for impacting a workpiece (22), comprising;  
a casing (42) having a proximal end (44) and a distal end (46) and defining a  
5 chamber (48) therebetween,  
an impactor device (24, 54) slidable within said chamber (48) along an operational  
axis (A) to impact the workpiece,  
a valve system (100, 200) for selectively introducing and releasing pressurized fluid  
into and out from said chamber (48) to slide said impactor device (24, 54) within said  
10 chamber (48) along said operational axis (A), and  
an energy absorbing mechanism (402) including a sleeve (404) slidable along said  
distal end (46) of said casing (42) to define a first pressure chamber (412) with said  
impactor device (24, 54) for reducing the kinetic energy of said impactor device (24, 54) in  
a first stage immediately after movement thereof by compressing pressurized fluid within  
15 said first pressure chamber (412),  
said tool (20) characterized by said energy absorbing mechanism (402) further  
comprising a second pressure chamber (414) defined between said casing (42) and said  
sleeve (404) for reducing the kinetic energy of said impactor device (24, 54) in a second  
stage by compressing pressurized fluid within said second pressure chamber (414) after  
20 compressing the pressurized fluid in said first pressure chamber (412) when said impactor  
device (24, 54) impacts said sleeve (404).
2. A tool as set forth in claim 1 wherein said sleeve (404) includes a first  
annular wall (406) and a second annular wall (408) coaxial with and surrounding said first  
25 annular wall (406) with an annular groove defined therebetween and said casing (42) is  
slidable within said annular groove.
3. A tool as set forth in claim 2 wherein said first pressure chamber (412) is  
defined between said first annular wall (406) and said impactor device (24, 54) and said  
30 second pressure chamber (414) is defined between said casing (42) and said second annular  
wall (408) and said first pressure chamber (412) is radially offset from said second pressure  
chamber (414) relative to said operational axis (A).

4. A tool as set forth in claim 1 wherein said impactor device (24, 54) comprises a tool bit (24) and a piston (54) independent and separable from said tool bit (24) whereby said piston (54) slides within said chamber (48) upon actuation of said valve system (100, 200) to impact said tool bit (24) and drive said tool bit (24) into the workpiece (22) and said first pressure chamber (412) reduces the kinetic energy of said tool bit (24) after impact by said piston (54) by compressing pressurized fluid within said first pressure chamber (412) and said second pressure chamber (414) reduces the kinetic energy of said tool bit (24) after compressing the pressurized fluid in said first pressure chamber (412) when said tool bit (24) impacts said sleeve (404).

5. A tool as set forth in claim 1 wherein said first (412) and second (414) pressure chambers are annular in shape and said casing (42) defines a fluid passage (416) for providing fluid communication between said first (412) and second (414) pressure chambers.

6. A tool as set forth in claim 5 further including a source of pressurized fluid fluidly connected to said fluid passage (416) for pressurizing said first (412) and second (414) pressure chambers.

7. A tool as set forth in claim 6 wherein said fluid passage (416) further includes a restrictor orifice (400) for restricting fluid flow into and out from said fluid passage (416) as said first (412) and second (414) pressure chambers are compressed in the first and second stages.

8. A tool as set forth in claim 4 wherein said casing (42) comprises a power barrel (52) and a tool barrel (50) fixed to said power barrel (52) with said piston (54) being slidable in said power barrel (52) and said tool bit (24) being slidable in said tool barrel (50).

9. A tool as set forth in claim 8 wherein said tool bit (24) comprises a bit (420) having a head (422) and a ram (426) separable from said bit (420) for impacting said head (422) of said bit (420) to drive said head (422) through said first pressure chamber (412).

10. A tool as set forth in claim 9 wherein said tool barrel (50) includes proximal and distal ends and said tool barrel (50) defines a bore in said proximal end (44) for slidably receiving and supporting said ram (426).

5 11. A tool as set forth in claim 10 further including an impact chamber between said proximal end of said tool barrel (50) and said head (422).

12. A tool as set forth in claim 11 further including a vent port (436) defined within said tool barrel (50) for preventing a vacuum in said impact chamber when said bit (42) is driven distally by said ram (426).  
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13. A tool as set forth in claim 11 further including a vent port (438) defined within said sleeve (404) for preventing a vacuum between said sleeve (404) and said tool barrel (50) as said sleeve (404) slides along said tool barrel (50) to reduce the energy of said tool bit (24).  
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14. A tool as set forth in claim 4 wherein said valve (100, 200) comprises an exhaust valve (100) having a valve housing (102) concentrically surrounding said casing (42) and a sliding sleeve (108) for sliding between said casing (42) and said valve housing (102) to expose ports (110) defined annularly about said casing (42) and release pressurized fluid within said chamber (48) to atmosphere.  
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15. A tool as set forth in claim 14 wherein said valve system (100, 200) further comprises a pilot valve (200) having a valve housing (202) and a plunger (206) slidable within said valve housing (202) for selectively introducing pressurized fluid into and out from said chamber (48) by controlling said exhaust valve (100).  
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16. A tool as set forth in claim 15 further including a bleeder valve (300) for assisting the return of said piston (54) to an un-actuated position within said chamber (48) after said tool bit (24) impacts the workpiece (22) by bleeding pressurized fluid within said chamber (48) proximally of said piston (54) to the atmosphere after actuation.  
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17. A tool as set forth in claim 16 further including a shock absorbing valve (500) having two seal rings (504) spaced from one another and concentrically fixed to said casing (42) and a floating collar (502) slidably and concentrically coupled to said casing (42) between said seal rings (504) to define first (506) and second (508) annular envelopes  
5 whereby said annular envelopes (506, 508) selectively pressurize and de-pressurize to reduce recoil shock of the tool (20) as said floating collar (502) slides on said casing (42) between said seal rings (504) when said tool (20) recoils.

18. A tool as set forth in claim 17 further including an outer casing (56)  
10 surrounding said casing (42) and sealably defining a reserve chamber (58) therebetween for holding pressurized fluid.

19. A tool as set forth in claim 18 further including a pressure reducing check  
15 valve (600) for reducing the pressure of fluid entering into said reserve chamber.

20. A pneumatic tool (20) for impacting a workpiece (22), comprising;  
a casing (42) defining a chamber (48),  
a piston (54) slidable within said chamber (48) along an operational axis (A),  
an exhaust valve (100) for selectively introducing and releasing pressurized fluid  
5 into and out from said chamber (48) to slide said piston (54) within said chamber (48) along  
said operational axis (A),  
a pilot valve (200) for controlling said exhaust valve (200),  
a tool bit (24) independent of and separable from said piston (54) and slidable  
within said chamber (48) for receiving an impact from said piston (54) thereby driving said  
10 tool bit (24) into the workpiece (22),  
an energy absorbing mechanism (402) including a sleeve (404) slidable along said  
casing (42) for reducing the kinetic energy of said tool bit (24),  
said energy absorbing mechanism further comprising a first pressure chamber (412)  
defined between said tool bit (24) and said sleeve (404) and a second pressure chamber  
15 (414) defined between said casing (42) and said sleeve (404) to reduce the kinetic energy of  
said tool bit (24) in first and second stages by compressing pressurized fluid in said pressure  
chambers (412, 414), and  
a restrictor orifice (400) in fluid communication with both of said pressure  
chambers (412, 414) for slowly releasing fluid from each of said pressure chambers (412,  
20 414) as the pressurized fluid in each of said pressure chambers (412, 414) is compressed in  
the first and second stages.